

**CHEMETCO, INC.
1198010003--MADISON COUNTY
ZINC OXIDE SPILL
REMEDICATION PLAN**

PHASE I - MATERIAL REMOVAL AND PARTIAL CLOSURE

PREPARED FOR:

**Chemetco, Inc.
Hartford, Illinois
1198010003 -- Madison County**

Revised OCTOBER 1997



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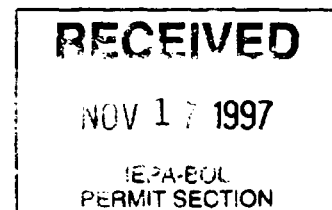
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CHEMETCO, INC.
1198010003 -- MADISON COUNTY
REMEDIATION PLAN FOR ZINC OXIDE SPILL AREA
PHASE I - MATERIAL REMOVAL AND PARTIAL CLOSURE
OCTOBER 1997

1.0 Introduction

A spill of zinc oxide was reported by Chemetco, Inc. (Chemetco) to the National Response Center and the Illinois Emergency Management Agency on September 19, 1996. The spill was found during a routine RCRA inspection conducted by the Illinois Environmental Protection Agency (IEPA) on September 18, 1996. Personnel from the United States Environmental Protection Agency (USEPA) were also present during the inspection. During the inspection, material that appeared to be zinc oxide was discharging from a pipe located south of Oldenburg Road. Sample results confirmed the spilled material was zinc oxide.

The IEPA has requested a RCRA closure plan be submitted for the spill area. In the course of negotiation, Chemetco has agreed to close the area in accordance with RCRA closure protocol. Submittal of this plan is not in any way an admission of Chemetco's behalf that the spill area is subject to RCRA requirements. The spill remediation plan will be submitted in two phases. Phase I will discuss Material Removal and Partial Demonstration of Clean Closure. Phase II will focus on Final Demonstration of "Clean Closure". This plan addresses Phase I - Material Removal and Partial Demonstration of Closure.



2.0 Facility Description

The Chemetco facility was constructed in 1969 and commenced production of anode copper, cathode copper, crude lead-tin solder, zinc oxide and slag in 1970. The Chemetco facility is located within a primarily agricultural, light residential area south of Hartford and is bounded on the west by major, heavily traveled rail and highway routes and on the south by a limited use secondary road. More specifically, the 200+ acre plant site is in the Southeast 1/4, Section 16, Township 4 North, Range 9 West of the Third Principal Meridian, in Madison County (see Figure 2-1).

2.1 Facility Address and Identification Numbers

Chemetco, Inc.
Route 3
Hartford, IL
IEPA #1198010003
USEPA # ILD048843809

2.2 Description of Spill Area

The spill was discovered during an IEPA inspection on September 19, 1996. CSD Environmental was retained on September 20, 1996 by Chemetco to conduct remediation of the spill area. During excavation activities, layers of zinc oxide material were found to a depth of 6 feet in Long Lake indicating historical management of zinc oxide.

This remediation plan addresses source removal of zinc oxide from a spill area

approximately 300 feet long by 450 feet wide. Initially the spill area was reported to be approximately 600 feet wide, however, surveying confirmed the area to be 450 feet wide. To contain the spill, four separate containment areas were constructed within the impacted area. Containment Area # 1 contains the zinc oxide removed from the other three containment areas. Containment Area #1 measures approximately 200 x 370 feet and has approximately 1,500 cubic yards of zinc oxide stored within it. Containment Area #2 measures approximately 300 x 50 feet (initially reported as 90 feet) and was constructed to temporarily hold diverted water from a portion of Long Lake. Approximately 575,000 gallons of water is estimated to be stored in Containment Area #2. Containment Area #3 measures 250 x 200 feet. Zinc oxide was removed from Containment Area #3 and was placed into Containment Area #1. Containment Area #4 measures 200 x 300 feet and was not affected by the spill to the degree that the other containment areas were. Any visible zinc oxide found in Containment Area #4 was placed into Containment Area #1. Refer to Figure 2-2 for the spill location and the containment areas.

3.0 Overview of Removal Procedures Completed

A work plan for the immediate response to the spill was submitted by CSD Environmental Services, Inc. (CSD) to the Illinois EPA on September 25, 1997. On September 30, 1997, the IEPA responded to the plan requesting additional information. A revised work plan was submitted on October 10, 1996 addressing their concerns. Attachment 1 contains a copy of the October 10, 1996 Revised Work Plan. The Work Plan addressed temporary containment and removal of the zinc oxide from Containment Area #3.

The spill area was inspected by CSD Environmental to evaluate the best options for remediation. Visual criteria was used to delineate the extent of the spill area. Initially a diversion channel was constructed to reroute the lake past the spill area. A Section 404 Permit, of the Clean Water Act (CWA), was received by the Army Corp of Engineers (Corp) to build a diversion channel and two dams on Long Lake. Attachment 2 contains a copy of the permit and permit application received from the Corp.

3.1 Containment

The following items were constructed to achieve containment of the spill area:

- A road was constructed using limestone rock to allow heavy equipment and trucks access to the spill area. The road was advanced over impacted soil and will be removed to enable soil remediation after the zinc oxide from Containment

Area #1 is removed. The north side of the road was lined with a 8 to 10 millimeter thickness polyethylene plastic to inhibit water from flowing under the dam. Limestone rock was placed on top of the liner to hold it in place.

- An earthen berm approximately 3 to 5 feet in height was constructed around the entire perimeter of the spill area. Surface water was diverted around the impacted area through a drainage ditch.
- A diversion channel 25 feet wide and 3 to 5 feet in depth was constructed to reroute water in Long Lake around the spill area. Two dams were constructed on Long Lake to assist in the diversion.

3.2 Dewatering

To remove the zinc oxide from Long Lake (Containment Area #3), dewatering was required. An impoundment was constructed within the contained spill area to hold water pumped from Containment Area #3. Prior to constructing the impoundment, any visual zinc oxide within the area was pushed with a bulldozer to the southwest corner of the spill area. An impoundment approximately 300 feet long by 50 feet wide was constructed. This impoundment was labeled Containment Area #2. The construction of Containment Area #2, in effect created two additional containment areas within the larger bermed area, Containment Areas #1 and 4. Containment Area #1 contained the largest percent of zinc oxide from the spill, therefore it was decided this area would be best suited to contain the zinc oxide to be removed from Long Lake. Containment Area #4 was not as significantly impacted from the spill as the other others. Containment Area #4 was used for temporarily

storing vegetation removed from the spill area and rock removed from the temporary pads constructed within Long Lake to allow equipment access. The portion of Long Lake to be dewatered and remediated was labeled Containment Area #3. Refer to Figure 2-2 for the spill locations and the containment areas.

3.3 Zinc Oxide Removal from Containment Area #3 (Long Lake)

The water from Containment Area #3 was transferred to Containment Area #2 using portable trash pumps. Two pads were constructed of limestone rock on the north side of Long Lake to allow the trackhoe access to the south side of the lake. All vegetation and debris (logs) within Long Lake were removed and temporarily stockpiled within Containment Area #4 for further handling. After the vegetation was removed and the dewatering was completed, excavation of impacted soils was initiated. Visual criteria was used to determine the initial excavation depth. Visual inspection of the soil revealed the zinc oxide extended to a depth of approximately 6 feet indicating the area was impacted from historical management of zinc oxide. Three sediment samples were collected after the initial excavation to determine if additional excavation was necessary. Refer to Figure 3-1 for the location of the sediment samples. Table 1 summarizes the analytical results. Copies of the analysis are provided in Attachment 3.

The sample results confirmed the visual criteria used to determine the initial excavation depth was an excellent indicator to identify the extent of contamination. Additional excavation was conducted in the area of sample 3. The temporary pads constructed to allow access across Long Lake were removed and temporarily stockpiled in Containment Area #4.

A Sampling and Analysis Plan was submitted to the IEPA on October 10, 1996. The sampling and analysis plan identified the sample locations and sampling parameters to determine closure. The plan was verbally approved by the IEPA on October 21, 1996. Refer to Attachment 4 for a copy of the Sampling and Analysis Plan.

Photographs documenting the containment of the spill area, construction of containment area #2 and removal of the zinc oxide from Containment Area #3 (Long Lake) are provided as Attachment 5.

Table 1
Soil Samples - Long Lake - After Initial Excavation
October 9, 1997
Chemetco, Inc.

Sample Number: Parameter:	Long Lake 1	Long Lake 2	Long Lake 3
Total Metal Analysis in mg/kg			
Cadmium	56.3	8.3	16.1
Lead	27.1	75.5	333
Zinc	519	498	716
TCLP Metal Analysis in mg/l			
Cadmium	<0.004	<0.004	1.3
Lead	<0.042	<0.042	10.4
Zinc	4.5	4.9	77.1
IEPA Clean Up Objectives			
Cadmium	0.005		
Lead	0.0075		
Zinc	5.0		

Clean up objectives as proposed in Title 35: Environmental Protection: Subtitle G: Waste Disposal: Chapter I; Pollution Control Board; Subchapter F: Risk Based Cleanup Objectives; Part 742 - Tiered Approach to Corrective Action Objectives; Class I - Migration to Groundwater Route Values. Those TCLP values exceeding the objectives are highlighted. No objectives are identified for total metal values.

3.4 Vegetation Removal

To remove the zinc oxide from the impacted area, it was necessary to remove standing and fallen trees to allow equipment access to the area. The trees removed were cut with chain saws above the roots. If visible zinc oxide was detected on the tree, the cut was made above the visual point. The trees were fed through a large tub grinder for shredding. The shredded material was temporarily stockpiled in Containment Area #4 for further handling. The tree roots were removed by excavation and also placed in Containment Area #4. The tub grinder was decontaminated using a high pressure steam wash before leaving the job site. All decontamination waters were containerized in a 475 gallon polyethylene tank and transferred to Containment Area #2, pending future on-site treatment.

In August of 1997, the tree stumps, shredded wood and limestone rock were removed from containment area #4 and placed into Containment Area #1. The zinc oxide in Containment Area #2 was reworked to allow a plastic cap to be installed. Care was taken to work the zinc oxide in a wet form only. A cap of 10 - 12 millimeters in thickness will be installed over the zinc oxide in October or November of 1997. The cap is proposed to control wind dispersal and infiltration to the groundwater.

4.0 Sampling and Analysis of Containment Areas 3 and 4

Sampling of Containment Area # 3 and a partial area of Containment Area #4 was conducted on October 23, 1996. Sampling was conducted in accordance with the approved Sampling and Analysis Plan except for the following changes:

- The area of Containment #3 was measured and found to be 28,600 ft² instead of 50,000 ft² . The grid interval was changed to 50 feet to account for the decrease in the square footage.
- Sampling was conducted using a skid loader and five foot stainless steel split spoon samplers where possible. The original sampling and analysis plan indicated sampling would be conducted using a hand auger. The use of the split spoons allowed for a five foot sample to be collected at each sample location. Three split spoons were used to speed in sample collection. Each split spoon was decontaminated between samples by washing withalconox, followed by steam cleaning and finally a tap water rinse.

Sampling began with CSD Environmental and Western Environmental personnel establishing the grid interval and marking each grid node with a construction stake. Each grid node was given a sample number identifying the sample location. Numbering corresponded to the Containment Area. For example, all samples from Containment Area #3 were identified as CA-3-#. Samples from Containment Area #4 were identified as CA-4-#. Samples were collected to demonstrate closure from Containment Areas 3 and 4. Only a portion of Containment Area #4 was sampled

since the remainder of the area was flooded. Samples will be collected from Containment Areas 1, 2, and the remainder of 4 when the zinc oxide and water within containment is removed. Samples were collected at depths of 6" and 18" below grade from all sample locations. In addition, at the request of the IEPA, samples from a depth of five feet were collected at three locations within Containment Area #3; CA3-3; CA3-4 and CA3-7. Figure 4-1 indicates the sample locations. The skid loader was not able to reach sample locations 6 and 9 within Containment Area #3 therefore, samples CA3-6 and CA3-9 were collected using a hand auger. The depth of the augured hole was measured with a tape measure to ensure samples were collected from the correct depths. Decontamination procedures of the hand auger were identical to those of the five foot split spoons.

Each sample was placed into laboratory provided glass jars. The jars were labeled indicating the sample location and depth, company name, and samplers initials. The jars were immediately placed into a pre-chilled cooler of approximately 4 degrees C. Each cooler was provided with a chain of custody form. The samples were hand delivered to Prairie Analytical Systems, Inc. in Springfield, Illinois by CSD personnel within 24 hours of sample collection.

All rinse waters used for decontamination were captured and containerized into a 475 gallon polyethylene tank. The rinse waters were transported to Containment Area #2 pending future on-site treatment. Refer to Section 5.2.

4.1 Establishment of Site Specific Clean Up Objectives

On June 5, 1997, the Agency's Tiered Approach to Corrective Action Objectives

(TACO) was finalized by the Illinois Pollution Control Board. TACO allows two different methods for the establishment of Tier 1 clean up objectives for metals. One method allows for pH of the soils to be considered. Additional sampling was conducted to determine site specific clean up objectives. Specifically, the pH of the soils and the concentration of total lead, cadmium and zinc in the soil was needed. On August 13, 1997, a hand auger boring (RA-1) was advanced to a depth of four feet at a location approximately forty feet north of MW-9. A soil sample was collected at this location and sent to Prairie Analytical Systems, Inc. (Prairie), in Springfield, IL, for analysis of pH. In addition to the sample collected from boring RA-1, soil samples were also collected from various locations in Containment Area #4, from beneath the rock road, and the ditch. A drill rig was used to collect the samples from beneath the rock road. Refer to Figure 4-2 for the rock road and ditch sample locations. The samples were sent to Prairie for analysis of total lead, cadmium and zinc. Analytical results are provided in Attachment 6.

On September 22, 1997 additional samples were collected from Containment Area #3 for analysis of total lead, cadmium and zinc. These samples were collected by chaining a five foot split spoon sampler to the bucket of trackhoe. The construction stakes marking the locations of the previous samples (refer to Figure 4-1) were used to determine sample locations. Samples were collected from CA3-1, CA3-2, CA3-4, CA3-5, CA3-6 and CA3-9. Locations CA3-7 and CA3-8 were not accessible to the trackhoe. The samples were sent to Prairie for analysis of total lead, cadmium and zinc. The sampling procedures discussed in Section 4.0 were followed for all samples collected. Analytical results are provided in Attachment 6.

- Analysis showed the native soil in the area of the zinc oxide spill has a pH of 8.34.

Using 35 IAC Part 742, Appendix B, Table C, *pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class I Groundwater)*, cleanup objectives of 430 mg/kg and 53,000 mg/kg were established for total cadmium and total zinc, respectively. Using Appendix B, Table B, *Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties*, a remediation objective of 400 mg/kg was established for total lead.

4.2 Analytical Results - Containment Area #3

Tables 2 and 3 summarize the TCLP and total sample results collected from Containment Area 3. The sample results from Containment Area #3 indicate the clean up objectives have been met and no soil remaining in Containment Area #3 exhibits a hazardous characteristic. Samples for total lead, cadmium and zinc were not collected from locations CA3-7 and CA3-8 due to limited access. However, analyses of the twenty one samples collected from Containment Area #3 indicate the soils remaining are far below the applicable clean up objectives. Copies of the analytical results are provided in Attachment 6. *CSD, on behalf of Chemetco requests closure of Containment Area #3 from the IEPA.*

Table 2
 TCLP Soil Sample Results
 Containment Area #3
 Chemetco, Inc.
 October 24, 1996

Sample Number	Cadmium mg/l	Lead mg/l	Zinc mg/l
Regulatory Limit- 721.124	1.0	5.0	NA
CA3-1-6"	0.013	0.012	<0.002
CA3-1-18"	<0.001	<0.001	<0.002
CA3-2-6"	<0.001	<0.001	<0.002
CA3-2-18"	<0.001	<0.001	<0.002
CA3-3-6"	0.005	<0.001	0.04
CA3-3-18"	0.007	<0.001	<0.002
CA3-3-5'	0.020	<0.001	<0.002
CA3-4-6"	0.007	<0.001	<0.002
CA3-4-18"	0.005	<0.001	<0.002
CA3-4-26"	0.008	<0.001	<0.002
CA3-4-5'	0.007	<0.001	<0.002
CA3-5-6"	0.010	<0.001	<0.002
CA3-5-18"	0.006	<0.001	<0.002
CA3-6-6"	0.066	<0.001	<0.002
CA3-6-18"	0.061	<0.001	<0.002
CA3-7-6"	0.48	<0.001	8.1
CA3-7-18"	0.009	<0.001	0.21
CA3-7-5'	0.106	<0.001	1.32
CA3-8-6"	0.010	<0.001	<0.002
CA3-8-18"	0.010	<0.001	0.24
CA3-9-6"	0.029	<0.001	0.70
CA3-9-18"	0.047	<0.001	<0.002

Table 3
Total Soil Sample Results
Containment Area #3
Chemetco, Inc.
September 22, 1997

Sample Number	Cadmium mg/kg	Lead mg/kg	Zinc mg/kg
Remediation Obj.	430 ¹	400 ²	53,000 ¹
CA3-1 6"	0.9	11	43
CA3-1 18"	2	11	30
CA3-1 4'	2	11	29
CA3-2 6"	2	13	33
CA3-2 18"	2	10	33
CA3-2 5'	1	7	23
CA3-3 6"	2	16	42
CA3-3 18"	1	12	43
CA3-3 5'	1	11	43
CA3-4 6"	1	8	32
CA3-4 18"	2	6	28
CA3-4 5'	1	9	35
CA3-5 6"	3	7	33
CA3-5 18"	3	10	38
CA3-5 5'	1	<2	20
CA3-6 6"	1	10	68
CA3-6 18"	1	59	89
CA3-6 3.5'*	0.5	7	21
CA3-9 6"	2	10	26
CA3-9 18"	3	9	44
CA3-9 5'	0.6	<2	14

¹Objective established using 35 IAC Part 742, Appendix B, Table C - pH Specific Soil Remediation Objectives for Inorganics for the Soil Component of the Groundwater Ingestion Route (Class I). ²A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12. * Split spoons did not retain full five foot sample.

4.3 Analytical Results - Containment Area #4

Tables 4 and 5 summarize the TCLP and total sample results collected from Containment Area #4. Comparison of the soil sample results from Containment Area #4 with the cleanup objectives being proposed, indicates that no further remediation is required in the areas from which these samples were collected. Analytical results are provided in Attachment 6. *CSD, on behalf of Chemetco, is requesting that closure of this portion of the spill area be granted.*

Table 4
TCLP Soil Sample Results (mg/l)
Containment Area #4
Chemetco, Inc.
October 24, 1996

Sample Number	Cadmium mg/l	Lead mg/l	Zinc mg/l
Regulatory Limit from 721.124	1	5	NA
CA4-1-6"	0.018	<0.001	<0.002
CA4-1-18"	<0.001	<0.001	<0.002
CA4-2-6"	0.048	<0.001	<0.002
CA4-2-18"	0.014	<0.001	0.53
CA4-3-6"	<0.001	<0.001	<0.002
CA4-3-18"	0.005	<0.001	<0.002
CA4-4-6"	0.053	0.472	0.16
CA4-4-18"	0.107	0.047	11.7
CA4-5-6"	<0.001	<0.001	3.97
CA4-5-18"	0.032	<0.001	<0.002
CA4-9-6"	0.014	<0.001	<0.002
CA4-9-18"	<0.001	<0.001	<0.002

Table 5
Total Soil Sample Results (mg/kg)
Containment Area #4
Chemetco, Inc.
August 13, 1997

Location/Parameter	Total Cd	Total Pb	Total Zn
Remediation Obj.	430 ¹	400 ²	53,000 ¹
CA4-1 (6")	2	41	131
CA4-1 (18")	.6	12	56
CA4-2 (6")	5	37	139
CA4-2 (18")	.7	13	41
CA4-3 (6")	10	74	224
CA4-3 (18")	2	17	52
CA4-4 (6")	2	71	207
CA4-4 (18")	1	23	70
CA4-5 (6")	.6	14	57
CA4-5 (18")	1	15	49
CA4-9 (6")	1	28	92
CA4-9 (18")	1	13	57
B-1 (6")	19	217	579
B-1 (18")	6	80	184
B-1 (5')	1	13	49

B-1 samples were collected from the berm of Containment Area #2.

4.4 Analytical Results - Rock Road

To determine the extent of impacted soil beneath the Rock Road, a drill rig was used to advance seven samples below the rock. Refer to Figure 4-2 for sample locations. Samples were collected at three depths, 6", 18" and 5'. All samples were labelled RR- # and were collected in accordance with the procedures discussed in Section 4.0. The samples were analyzed for total lead, cadmium and zinc. A composite sample was collected for TCLP lead and cadmium. Table 6 summarizes the samples collected from beneath the rock road. The results indicate additional remediation is required in the areas of sample number seven (7). Sample results are available in Attachment 6.

Table 6
Total Soil Sample Results
Rock Road
Chemetco, Inc.
August 14, 1997

Location/Parameter	Total Cd	Total Pb	Total Zn
Remediation Obj.	430'	400'	53,000'
RR-1 6"	<0.2	13	55
RR-1 18"	0.6	13	47
RR-1 5'	<0.2	14	52
RR-2 6"	<0.2	15	62
RR-2 18"	<0.2	13	48
RR-2 5'	<0.2	17	50
RR-3 6"	<0.2	17	51
RR-3 18"	<0.2	14	47
RR-3 5'	<0.2	13	53
RR-4 6"	0.2	18	56
RR-4 18"	<0.2	17	43
RR-4 5'	0.8	18	45
RR-5 6"	0.8	23	49
RR-5 18"	1	16	47
RR-5 5'	<0.2	18	49
RR-6 6"	1	23	73
RR-6 18"	1	28	54
RR-7 6"	629	32607	33709
RR-7 18"	25	899	1772
RR-7 5'	1	34	64
Composite 6" (TCLP) mg/l	<0.04	<0.004	0.03
Composite 18" (TCLP) mg/l	<0.04	<0.004	<0.002
Composite 5' (TCLP) mg/l	<0.04	<0.004	<0.002

4.5 - Analytical Results - Ditch

Three soil samples were collected to determine the amount of soil excavation required in the ditch associated with the 10" pipe. Samples were labelled D-# and were collected at three depths, 6", 18" and 5'. Refer to Figure 4-2 for the sample locations. All samples were collected in accordance with the procedures discussed in Section 4.0. The samples were analyzed for TCLP and total lead, cadmium and zinc. Tables 7 and 8 summarize the samples collected. The results indicate additional remediation is required in the areas of sample numbers D-2 and D-3. Sample results are available in Attachment 6.

Table 7
Total Soil Sample Results (mg/kg)
Ditch
Chemetco, Inc.
September 8, 1997

Location/Parameter	Total Cd	Total Pb	Total Zn
Remediation Obj.	430 ¹	400 ²	53,000 ³
D-1 6"	3.1	132	346
D-1 18"	9.2	1926	19699
D-1 5'	<0.2	3.1	151
D-2 6"	161	13905	23431
D-2 18"	0.23	4.5	85
D-2 5'	0.48	7.3	48
D-3 6"	209	9740	2376
D-3 18"	105	1118	2.5
D-3 5'	0.8	2.5	62

Table 8
TCLP Soil Sample Results (mg/l)
Ditch
Chemetco, Inc.
September 8, 1997

Sample Number	Cadmium mg/l	Lead mg/l	Zinc mg/l
Regulatory Limit from 721.124	1	5	NA
D-1 6"	0.04	<0.04	3.5
D-1 18"	0.07	2.4	6.5
D-1 5'	<0.004	<0.04	0.08
D-2 6"	2.5	93	44
D-2 18"	<0.004	0.13	0.25
D-2 5'	<0.2	0.13	0.70
D-3 6"	3.5	96	44
D-3 18"	0.023	0.07	1.8
D-3 5'	0.012	0.07	0.26

Samples above the regulatory limit are highlighted.

5.0 Remediation

5.1 Containment Area #1

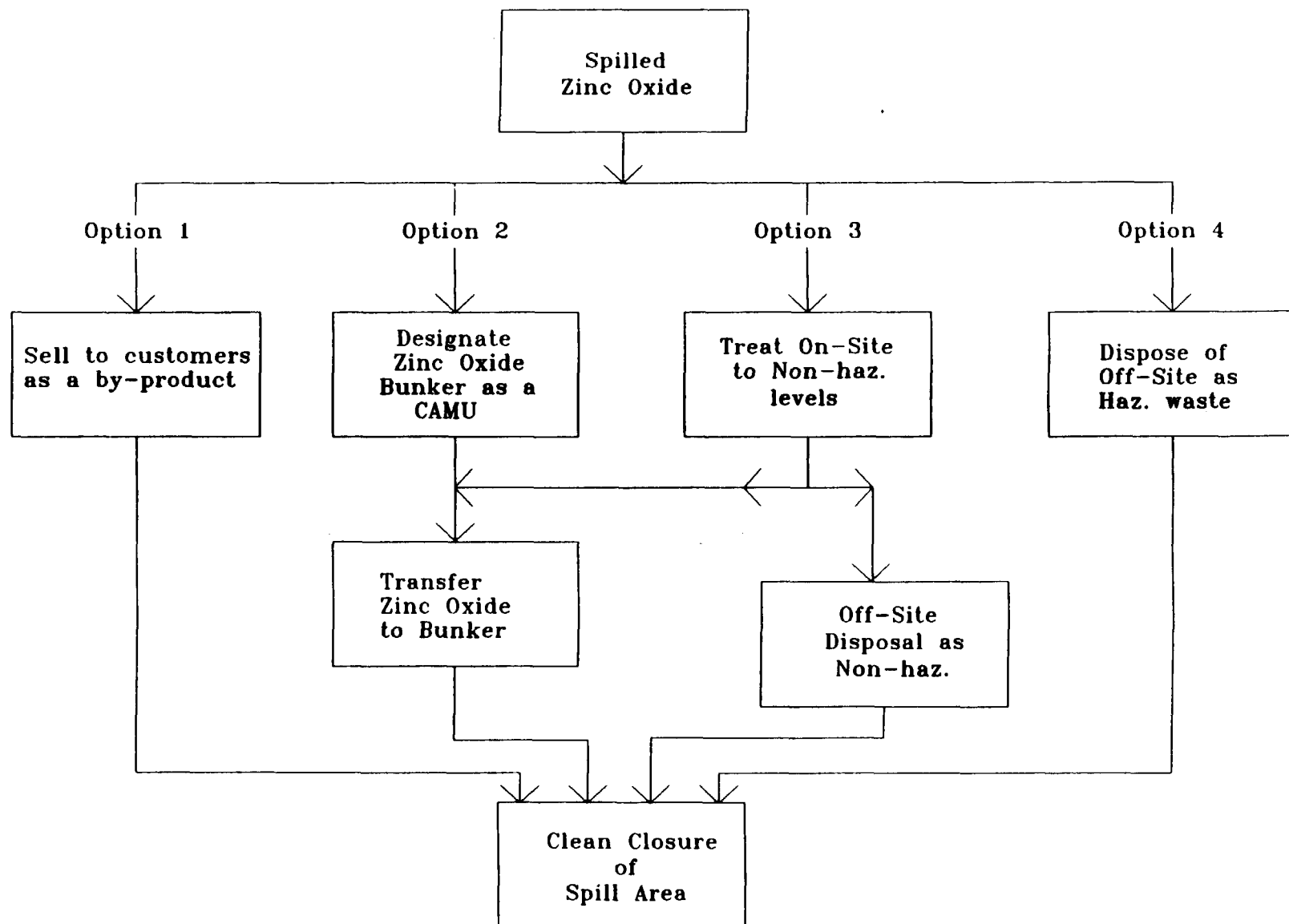
Chemetco intends to remove all the zinc oxide stored within Containment Area #1. Three options for handling the zinc oxide are discussed below and provided in Flowchart 5.1.

5.1.A. Removal Options - Zinc Oxide

5.1.A.1. Option 1 - Sale of Zinc Oxide to ELMET

Option 1: Sale of the zinc oxide to ELMET. The zinc oxide contained in Containment Area #1 (CA#-1) is a recyclable material due to level of lead, zinc, copper and precious metals contained within. Chemetco currently ships zinc oxide as a by-product to ELMET in Berango Spain for further metal recovery. Chemetco is negotiating with additional customers for the sale of zinc oxide material. Samples were collected of the zinc oxide to ensure the material will meet ELMET's specifications. A sampling grid consisting of 35 feet in the east - west direction and 40 feet in the north- south location was arranged. The south portion of the zinc oxide was estimated to be approximately 6 feet higher than the north portion, therefore, samples from the south side of CA#1 were collected at each grid interval from depths of 2, 4, and 8 feet. Samples were collected at a depth of 2 and 4 feet from the north portion. Refer to Figure 5-1 for sample locations.

Flowchart 5.1.A: Zinc Oxide Options



The samples were collected using a hand auger. Sample depth markings were placed on the extensions of the hand auger to ensure correct sampling depths. The samples were placed in one quart ziploc bags and delivered to MIDCO labs in St. Louis, MO for metal assaying. The assay results dictate the amount of copper/tin oxides required to be blended with the zinc oxide. The assay results will be sent to ELMET for pre-acceptance. If any of the samples are denied by ELMET, the zinc oxide from the corresponding sample location will be handled pursuant to option 2 described below.

If the material is found to be acceptable to ELMET, the zinc oxide will be loaded into trucks and transported to the Hartford Terminal for loading into barges for shipment to New Orleans, LA. The zinc oxide will be transferred to a ship in New Orleans for shipment to ELMET in Spain. Chemetco currently has a contract with ELMET to ship up to 3,000 tons of oxides per month. Enclosed as Attachment 7 is a copy of the contract between ELMET and Chemetco.

5.1.A.2 Option 2 - Placement into the Zinc Oxide Bunker

Option 2: To facilitate a rapid and cost effective site remediation, Chemetco requests the IEPA designate the zinc oxide bunker as a Corrective Action Management Unit (CAMU). Creation of a CAMU will allow Chemetco to place the spilled zinc oxide into the bunker without triggering land disposal restrictions or minimum technology requirements. If the Agency agrees to the CAMU approach, Chemetco will include in the Part B Permit a request for CAMU designation. The closure plan and closure cost estimate will be revised to reflect the addition of the material.

The material will be loaded into trucks, tarped and transported to the southwest corner of the zinc oxide bunker. The material will either be placed on the pile by either conveyer, crane or a haul road constructed. If it is necessary to unload the material from the trucks a containment area will be constructed. Care will be taken to ensure no RCRA regulated units are created during the transferring of material. Prior to placing the zinc oxide in the bunker, polyethylene sheeting will be placed over the existing zinc oxide in the bunker for segregation. It is estimated between 1,500 to 3,000 cubic yards of zinc oxide and contaminated stumps, wood, and limestone rock will be added to the bunker. Refer to Figure 5-2 for the placement location within the bunker. Chunky slag will be placed over the zinc oxide for wind protection. The fugitive dust plan will be revised to include the addition of material to the bunker. Chemetco proposes creation of a CAMU to 1) facilitate a reliable, effective and cost effective remedy; 2) to allow remediation activities associated with the spill to move forward; and 3) protect human health and the environment.

5.1.A.3. Option 3 - Off Site Disposal

Option 3: Ship the material as a hazardous waste for treatment or to a hazardous waste disposal facility.

Chemetco proposes to pursue Option 1, sale of the material as a by-product for further metal recovery. If the IEPA does not concur with Chemetco's interpretation that the zinc oxide material is a "saleable product", Chemetco proposes to proceed with Option 2 creation of the zinc oxide bunker into a CAMU.

5.1.B Removal Procedures Containment Area 1

Prior to removal of any zinc oxide, the water in Containment Area #1 will be pumped into Containment Area #2 to initiate the drying process. No removal can occur until the water currently stored within Containment Area #2 is removed to allow room for the additional water from Containment Area #1. See Section 5.2 regarding water removal from Containment Area #2.

5.1.B.1. - Zinc Oxide Loading

The fugitive dust plan will be amended to include loading of the zinc oxide material. The zinc oxide will be loaded "as is" into polyethylene lined trucks, covered and transported. If it is determined the zinc oxide is to wet to place into the trucks, the zinc oxide will be spread out in Containment Area #1 to allow natural drying of the material. Care will be taken to ensure the material is not over dried to become an air emission source.

5.1.B.2 - Contaminated Stumps, Wood, and Limestone Rock

Contaminated stumps, wood, and limestone rock is stored in Containment Area #1. Composite samples were collected of the soil held in the roots, shredded wood and limestone rock. The samples were sent to Prairie Analytical for analysis of TCLP lead, cadmium and zinc. The results indicated the roots, shredded wood, and limestone rock failed the TCLP test for lead and cadmium. Refer to Attachment 9 for a copy of the analytical results.

Chemetco proposes to dispose of the stumps, wood, and limestone rock as a hazardous waste if the Agency agrees to allow Chemetco to pursue Option 1 sale of the zinc oxide. If the Agency denies Option 1, then Chemetco proposes to place the contaminated stumps, wood, and limestone rock in the zinc oxide bunker designated as a CAMU.

5.2 Containment Area #2

Containment Area #2 measures approximately 300 x 90 feet and was constructed to temporarily hold water from the diverted portion of Long Lake. Prior to constructing the impoundment, any visual zinc oxide within the area was pushed with a bulldozer to the southwest corner of the spill area. Approximately 575,000 gallons of water is estimated to be stored in Containment Area #2. A sample of the water contained within Containment Area #2 was collected on October 11, 1996 and analyzed for Chemetco's NPDES discharge parameters pursuant to Chemetco's NPDES Permit #IL0025747. Table 4 summarizes the analytical results. Exceedences of the General Use Standards were found for Cadmium, Copper, Iron, Manganese, Lead, Suspended Solids and Zinc. CSD verbally requested approval from the IEPA, Bureau of Water, on October 21, 1996 for an emergency discharge of the water within Containment Area #2 to Long Lake. This request was denied by the IEPA, Bureau of Water on October 26, 1997. In response to the denial, CSD collected an additional sample of water from Containment Area #2 and analyzed for dissolved cadmium, copper, iron, lead, manganese and zinc. Sample results indicated after filtration cadmium, manganese and total suspended solids exceeded the general use standards. The sample results are provided in Table 5. On November 27, 1996, CSD submitted

a letter requesting the Agency's assistant in discussing disposal options for the impounded water. The IEPA responded by letter on December 6, 1997 denying a provisional variance request for discharge of the water. In response to the IEPA's variance denial, a formal request for a variance to discharge the water after treatment was requested by Chemetco on March 20, 1997. A copy of CSD's November 27, 1996 letter, the IEPA response, and Chemetco's March 20, 1997 request for a variance is provided as Attachment 8. The IEPA denied the request for a provisional variance on March 31, 1997. A meeting was held with the Bureau of Water on April 9, 1997 to discuss the variance denial. The Bureau of Water requested CSD submit an NPDES application to discharge the water. CSD explained that due to time constraints we were requesting the variance to discharge the water. CSD informed the Bureau that CA#2 needed to be dewatered in order to begin zinc oxide removal in CA#1. The Bureau again refused the variance request. In response to the variance denial, an application for an NPDES permit and a construction permit to temporarily discharge the impounded water was submitted to the IEPA on April 16, 1997. The NPDES application was granted, however the construction permit was denied. The temporary treatment plant could not treat the water to the discharge limitation imposed by the NPDES permit for discharge to Long Lake.

CSD will request the Bureau of Water allow the water to be transferred to the permanent storm water retention basin for treatment. Chemetco submitted an NPDES permit application to construct and operate a permanent storm water treatment system with discharge to Long Lake on August 4, 1997. This application will be revised in October 1997 to request construction of the retention basin to the adjacent field north of Chemetco's plant and discharge to the Cahokia Diversion Channel. Discharge into the Cahokia Diversion Channel will allow the IEPA to establish higher discharge limits

than those established in the NPDES permit for outfall 003.

5.2.A. Containment Area #2 Berms

The berms will be sampled in accordance with the procedures outlined in Section 4. Samples will be collected for TCLP and total pH, zinc, and cadmium of a 50 foot grid. Sample results will dictate if additional remediation is required. If the samples fail the TCLP test , the soil will either be 1) placed in the bunker designated as a CAMU; or disposed of as a hazardous waste. If the soils pass the TCLP test, but are above the site specific remediation objectives, the soil will be disposed of as non hazardous waste.

Table 4
Water Sample Result from Containment Area #2
Collected on October 11, 1996
Analyzed for NPDES Discharge Parameters
Total Metals

Parameter	Result in mg/l	General Discharge Standard
Silver	0.021	0.1
Boron	5.54	*
BOD	<7.5	30
Cadmium	0.563	0.15
Chlorine	<0.05	*
Copper	1.20	0.5
Iron	2.57	2.0
Hexane soluble Oil and Grease	11.5	15.0
Manganese	2.42	1.0
Nickel	0.14	1.0
Lead	1.59	0.2
Suspended Solids	67	15.0
Zinc	6.83	1.0

Those samples exceeding the General Use Standard as defined in 35 Ill. Adm. Code, Subtitle C, Part 304 are highlighted. * No standard has been established in 35 Ill. Adm. Code, Subtitle C, Section 304.

Table 5
Water Sample Result from Containment Area #2
Collected on October 28, 1996
Analyzed for NPDES Discharge Parameters
Dissolved Metal Analysis

Parameter	Result in mg/l	General Use Standard
Cadmium, diss	0.22	0.15
Copper, diss	0.136	0.5
Iron, diss	<0.007	2.0
Lead, diss	0.010	0.2
Manganese, diss	2.14	1.0
Zinc, diss	0.68	1.0
Total Suspended Solids	23	15
pH	8.53	6-9

5.3 Removal Procedures Containment Area #4

All visible zinc oxide was removed from Containment Area #4 and placed into Containment Area #1 at the time of construction of Containment Area #2. Tree stumps, shredded trees and rock were temporarily stored in Containment Area #4. The stumps, wood, and limestone rock were moved in August 1997 into Containment Area #1.

5.4 Removal Procedures for the Ditch

The vegetation in the ditch was removed in August of 1997. All vegetation was placed into Containment Area #1. Soil samples were collected for total and TCLP lead and cadmium. Refer to Section 4.5 for a discussion of the sample results. The results indicated additional excavation in the area of samples D-2 and D-3 is needed. Specifically, excavation from 0 to 18 inches is required in the area of sample D-2 and 0 to 5 feet in the area of sample D-3. Refer to Figure 5-3 for the additional area to be excavated. It is estimated an additional 106 cubic yards of impacted soil will be excavated. The soil removed will be placed into Containment Area #1 and handled pursuant to the zinc oxide options provided in Section 5.1.A.

5.5 Rock Road and Decontamination Pad

Analytical results indicated additional excavation in the area of samples RR-7 is needed. Specifically, excavation from 0 to 18 inches is required in the area of sample

RR-7. Refer to Figure 5-4 for the additional area to be excavated. It is estimated an additional 37 cubic yards of impacted soil will be excavated. The soil removed will be placed into Containment Area #1 and handled pursuant to the zinc oxide options provided in Section 5.1.A.

6.0 Proposed Sampling and Analysis to Demonstrate Clean Closure

Sampling and analysis of Containment Areas #1, 2, the remainder of 4 and the ditch will be conducted as described in Sections 6.1, 6.2, and 6.3 below. Phase II of the Remediation Plan - Demonstration of Clean Closure will be submitted within 90 days after all sampling is completed.

6.1 Sampling and Analysis of Containment Areas #1 and #2

Following removal of the zinc oxide material, the procedures outlined in CSD's Sampling and Analysis Plan dated October 10, 1996 will be followed except for the following:

Sampling will be conducted using a skid loader and five foot stainless steel split spoon samplers. Each split spoon will be decontaminated between samples by washing withalconox , followed by steam cleaning, and finally a tap water rinse.

6.2 Sampling & Analysis of Remainder of Containment Area 4

A partial sampling of this area was conducted on October 23, 1996 and August 13, 1997. Samples were collected from locations CA4-1, CA4-2, CA4-3, CA4-4, CA4-5 and CA4-9 on October 25, 1996 for TCLP lead, cadmium and zinc. All samples were below the regulatory limit for hazardous waste. To determine clean up objectives additional samples were collected from the same locations in August of 1997 for total metal analysis of lead, cadmium and zinc. All sampling conducted to date indicates all

samples are below the established clean up objectives. Refer to Section 4. 1 for a discussion of the clean up objectives. The remainder of the samples were not collected due to the presence of Containment Area #2 and contaminated stumps, wood, and limestone rock. The stumps, wood, and limestone rock have been removed, but Containment Area #4 was too wet in September 1997 to allow sampling to occur. In the event the area dries, samples CA4-5 and CA4-10 will be collected. The samples will be collected using the same procedures described in Section 6.1 for Containment Area #1.

6.3 Sampling and Analysis of the Ditch

After the excavation discussed in Section 5.4 is conducted, the ditch will be re-sampled. In accordance with Section 4.0, a grid interval of 50 feet will be established for confirmatory sampling. The samples will be collected using the same procedures described in Section 6.1 for Containment Area #1.

6.4 Sampling and Analysis of the Rock Road

After the excavation discussed in Section 5.5 is conducted, the rock road will be re-sampled. In accordance with Section 4.0, a grid interval of 50 feet will be established for confirmatory sampling. The samples will be collected using the same procedures described in Section 6.1 for Containment Area #1.

7.0 Groundwater Monitoring Plan

The purpose of this proposed Phase I groundwater investigation, is to determine the absence/presence of hazardous constituents in the shallow perched aquifer related to the zinc oxide spill. Well installation will confirm or deny the existence of the shallow perched aquifer encountered during previous investigations at the facility north and east of the spill site as well as the subsurface characteristics.

7.1 Regional Geologic and Hydrogeologic Information

The Chemetco site is located in the floodplain of the Mississippi River in an area locally referred to as the American Bottoms. This area is characterized by relatively flat topography. The gradient of the Mississippi River in the American Bottoms is about 6 inches per mile or 9.5×10^{-5} . The land surface gradient over a similar area is about 12 inches per mile or 6.3×10^{-5} both of these gradients are extremely flat.

Precipitation to the American Bottoms falls on the flat surface and either infiltrates into the ground or evaporates. Because of the flat surface there is very little runoff. Recharge to the groundwater system in this area is received from the highlands surrounding the American Bottoms, infiltration from channels, and Mississippi River flood waters. Infiltration of water into the ground is restricted by the clay and silt layer found near the surface. Beneath the clay and silt layer lies the regional American Bottoms sand and gravel aquifer which extends to bedrock. The source of some recharge may be the bedrock aquifer near pumping centers. Under non-pumping conditions the regional groundwater flow in the American Bottoms aquifer is expected to be toward the west or southwest towards the Mississippi River.

The regional aquifer is generally greater than 90 feet thick and extends to the bedrock. Although there is not distinct boundary between the formations in the regional aquifer, the regional aquifer is considered here to be comprised of two distinct hydrogeologic units given the gradation from silty sand to coarse sand and gravel. The clean sand and gravel deposits in the bottom zone of the American Bottoms aquifer constitute the major water-producing zone in the area. These deposits are utilized as groundwater supplies for municipal and industrial withdrawals, including Chemetco. Figure 7-1.1 shows the groundwater divides created by the major pumping centers in the area of the Chemetco site (Kohlhase, 1987). In 1951 these pumping centers produced a maximum withdrawal of 110 million gallons per day (mgd). In 1985 the withdrawal rate had declined to about 60 mgd (Kohlhase, 1987).

The Illinois State Water Survey (Water Survey) conducts periodic water-level monitoring programs of selected wells in the American Bottoms aquifer. Utilizing this water-level data the Water Survey produces a potentiometric map of the aquifer. This potentiometric map shows that aquifer withdrawals have significantly changed the groundwater flow direction within the aquifer and the flow is directed towards the various pumping centers. Using the potentiometric map, the Water Survey has determined the approximate locations of groundwater divides between the pumping centers. These divides, whose exact locations change according to variations in recharge and withdrawal rates, delineate the approximate areas of influence of the pumping centers.

Figure 7-1.1. shows the groundwater divides determined by the Water Survey (Kohlhase, 1987). This figure shows that the Chemetco site is on the edge of the area of influence of the Poag pumping center. The Chemetco site is also located just south

of the areas of influence of the Roxana and Wood River pumping centers. The regional mapping does not have sufficient delineation of the groundwater contours in the Chemetco site area to determine the regional direction of groundwater flow. The flow in this area, however, should be towards the Mississippi River.

Because of the prolific production of the American Bottoms aquifer, the limestone aquifer below the American Bottoms aquifer has not been tapped for groundwater supplies. It is believed, that the limestone aquifer could also be a source for high capacity production wells; water sampling in other areas has shown that this bedrock aquifer is highly mineralized.

7.1.1. Description of Class I Groundwater

The American Bottoms Aquifer as described in Section 7.1. and 7.2. is a Class I Groundwater pursuant to Ill. Administrative. Code, Part 620.210.

7.1.2. Identification of Private/Potable Water Supply Wells

The Chemetco facility is located in a sparsely populated area. Consequently the number of withdrawal wells within a one (1) mile of the site is low. The only commercial/industrial are Chemetco's own wells. The well water is used for human consumption.

Well logs for ten (10) private wells within one (1) mile of the Chemetco facility were obtained from, State Agencies. Figure 7-1.2. indicates their locations in relation to the site. Several of the wells indicated in the figure are believed to be no longer in use.

Through field investigations to be conducted concurrent with other field sampling activities, Chemetco will verify which wells remain in service in the area.

7.1.4. Identification of Units Beneath the Site Subject to Class I Standards

The American Bottoms Aquifer is subject to Class I standards as is any hydraulically connected unit. Therefore, the shallow perched aquifer, if encountered beneath the spill area, may also be subject to Class I groundwater quality standards.

7.1.5. Identification of the Source of All Municipal Water

The regional aquifer is reportedly a drinking water source downgradient of Chemetco; Hartford municipal wells are reportedly northwest of the facility. In addition, potable water for the Chemetco facility is drawn from the two facility water supply wells, screened in the lower regional aquifer.

7.2 Characterization of Geology

As previously stated, the purpose of this proposed Phase I groundwater investigation, is to determine the absence/presence of hazardous constituents in the shallow perched aquifer related to the zinc oxide spill. At this time it can only be assumed that the hydrogeologic/geologic conditions discussed below can be correlated from previously studied areas at this facility to the area beneath the zinc oxide spill. Well installation will confirm or deny the existence, as well as the characteristics, of

a shallow perched aquifer.

Chemetco has conducted interim-status groundwater monitoring for units north of the zinc oxide spill area since January 1983. During related investigations, it has been determined that the general hydrogeology of the site consists of an aquitard that contains lenses of water-bearing sand and silt underlain by the regional American Bottoms sand and gravel aquifer. A cross-section is included as Figure 7-2.1. The aquitard contains a perched sand aquifer that outcrops to surface south of the facility as depicted in Figure 7-2.2.

The Chemetco facility is underlain by a clay and silty clay unit ranging from approximately 20 to 60 feet in thickness. Interbedded within the clay in the southeastern quadrant of the facility is a sand lense (also referred to as the perched sand aquifer). The perched sand aquifer extends from 5 to 20 feet below grade with a maximum thickness of 15 feet and is bounded above and below by the clay and silty clay. The hydraulic conductivity of the perched unit has been calculated from slug test data to be 2.8×10^{-3} cm/sec. The results of site investigations indicate that the water flows from north to south across the southeastern quadrant of the facility. Data indicate the water-bearing formation does not extend to the facility northern and western boundaries and stops within 300 feet of the southern and eastern boundaries. A second sand and silt lense has been identified, based on water level elevations, to the east of well 12.

The clay layer averages 10 feet in thickness beneath the shallow perched zone and increases to 25 feet in thickness in the northern portions of the Chemetco facility (where the perched sand aquifer is not present). The hydraulic conductivity of the clay

layer based on slug test data indicate a hydraulic conductivity of 4.6×10^{-5} cm/sec which is two or more orders of magnitude lower than the aquifers and therefore constitutes an aquitard.

Beneath the clay is a layer of fine to silty sand that grades to coarse sand with depth and finally to sand and gravel. This unit is the regional American Bottoms Aquifer. The regional aquifer is generally greater than 90 feet thick and extends to the bedrock. Although there is not distinct boundary between the formations in the regional aquifer, the regional aquifer is considered here to be comprised of two distinct hydrogeologic units given the gradation from silty sand to coarse sand and gravel. The hydraulic conductivity of the upper regional zone determined by slug tests and pumping tests is 1×10^{-2} cm/sec. The hydraulic conductivity of the lower zone of the regional aquifer determined by pumping tests is 1×10^{-1} cm/sec. Regional groundwater flows under non pumping conditions towards the Mississippi River.

Chemetco will attempt to gather the following information during installation of the proposed well system specific to the area beneath the spill:

- A qualitative assessment of porosity, texture, uniformity, lithology of all significant units
- Significant structural features
- Stratigraphic contacts between significant formations/strata
- Zones of high permeability, fracture or channeling in consolidated and

unconsolidated deposits

- Perched aquifers
- Location of borehole, depth of termination
- Zone of saturation/thickness of the unit
- Interpretations of hydraulic connections between saturated zones

7.3 Proposed Monitoring Well System

A monitoring well system is proposed herein which is intended to yield representative groundwater samples from shallow groundwater beneath the Chemetco facility. Again, the purpose of this groundwater investigation is to determine whether shallow groundwater has been impacted by the zinc oxide spill undergoing clean-up.

7.3.1. Well Location and Screens

Based on data measurements collected during investigations conducted at Chemetco, flow in the shallow perched aquifer is thought to move predominately from north to south across the southeastern quadrant of the facility. Quarterly potentiometric maps for 1996, Figures 7-3.1. through 7-3.4., are included for reference. Therefore, Chemetco is anticipating a similar flow regime in the vicinity of the zinc oxide spill area. Chemetco proposes to install one upgradient well north of Containment area #1 as depicted in Figure 7-3.5. Three downgradient wells are

proposed along a primarily east-west traverse just south of Long Lake and the temporary diversion channel south of Containment Area #3 also as depicted in Figure 7-3.5. All wells will be screened at similar depths. Total depth of wells should not exceed 25 feet below ground surface (BGS). If no substantial sand lenses are encountered during drilling activities, the screens shall be set at the first water-bearing zone as encountered in the field. Hydraulic conductivity testing shall be performed in the field on all four wells.

7.3.2. Drilling Operations

Wells will be installed using a 4 1/4" hollow stem auger. There will be no addition of fluids or drilling muds. All drill cuttings will be containerized and disposed of properly.

7.3.3. Construction, Development, and Maintenance of Wells

All wells shall be constructed pursuant to Ill. Admin. Code, Part 920 of the Illinois Water Well Construction Code and the Well Construction Diagram included as Figure 7.3.6. All borings shall be continuously sampled using five foot split spoon samplers. A typical boring log and well completion report is included as Figures 7-3.7. and 7-3.8. Wells shall be constructed of the following materials:

- Well screens and risers shall be constructed of schedule 40 PVC, ASTM 2 pitch threads, 2 inch inside diameter;
- The screens shall be either 2 in/4 in Monoflex U-pack well screen, 0.010 inch

slot size, ten feet in length and prepacked with 20/40 grade silica sand; or, a 2 in, 0.010 inch slot size, ten feet in length schedule 40 PVC well screen;

- If a pre-packed screen is not utilized, an artificial filter pack shall be placed in the annular space between the borehole wall and the screen. The filter pack material shall be chemically inert and installed in a manner that prevents bridging and particle-size segregation. At least two inches of filter pack material should be installed between the well screen and the borehole wall.
- Casing and screen material are to be decontaminated prior to installation to remove any coatings or manufacturing residues. Decontamination includes a wash with a mild non-phosphate detergent/potable water solution and a rinse with potable water;
- Silica sand (20/40 grade) will be used to extend the filter pack to a length no greater than two feet above the top of the screen;
- A minimum of two feet of bentonite, either granular, pellets, or chips shall be placed around the casing by means of prehydrating at the surface and pumping through a tremie pipe. The bentonite seal is to be allowed to completely hydrate, set or cure in conformance with the manufacturer's specification prior to installing the grout seal in the annular seal;
- The annular space above the bentonite seal is to be filled with a neat cement containing bentonite from 2% to 6% by weight or a combination thereof;

- Wells will be constructed with a 4' by 4' concrete pad with (4) 6" steel bumper posts placed on the corners of the pad; and,
- Wells will be constructed with lockable steel well covers.

All wells shall be properly developed to ensure the collection of representative groundwater samples. All water removed from the wells shall be containerized until analyses are received from the lab, at which time it shall be disposed of appropriately.

The integrity and condition of each well shall be inspected quarterly during sampling activities. This shall be noted in the field notebook and sample collection record form. Any activities related to well maintenance shall also be recorded in the aforementioned records.

7.3.4. Protection and Identification of Wells

Wells will be protected from damage by constructing a 4' x 4' concrete pad with (4) 6" steel bumper posts on the corners of the pad. Lockable steel well covers, 4" x 5' in size, shall be also be utilized.

All wells shall be surveyed to determine their location as well as their distances from the spill area and their distance from each other. These locations shall be surveyed by a licensed professional surveyor (or equivalent) within +/-0.01 foot in relation to mean sea level, which in turn is established by reference to an established National Geodetic Vertical Datum. The surveyed reference mark shall be clearly and permanently marked on top of the inner well casing.

The well identification numbers, monitor point number, shall be clearly and permanently marked on the outside of the protective cover.

7.3.5. Well Replacement

A monitoring well will be replaced if it is damaged, if it does not consistently produce a sample, or if there are problems attributable to well construction. If a well is replaced, all conditions specified in Attachment E to the DRAFT IEPA RCRA Closure Guidance Document dated November 1994 as well as Ill. Admin. Code Part 920 will be followed.

7.3.6. Well Plugging and Abandonment Procedures

At such time a well must be plugged or abandoned, the Agency shall be notified and such activities shall be executed in accordance with 77 Ill. Admin. Code 920.120 (b) (7) by grouting from the bottom up with a tremie pipe using neat cement containing bentonite from 2% to 6% by weight or combination thereof. This material shall be applied the full depth of the well and terminate within three feet of the ground surface. Final three feet shall be filled with premix concrete to the surface. Monitor Well Reports shall be submitted to the Illinois Department of Public Health within 30 days after monitor wells have been completed on forms as are prescribed and furnished by the Department. Boring logs and monitor well completion reports shall be submitted as part of the report of findings for this Phase I investigation.

7.4. Sampling and Analysis Plan

Please refer to Attachment 10 which contains the Sampling and Analysis Plan.

7.5. Parameters

Since the groundwater monitoring proposed herein pertains to the zinc oxide spill, Chemetco is proposing to sample shallow groundwater for indicator parameters, the eight RCRA metals, and zinc as listed below:

- pH;
- Specific Conductance;
- TOX;
- TOC;
- Lead;
- Cadmium;
- Zinc;
- Arsenic;
- Barium;
- Silver;
- Mercury;
- Selenium; and,
- Chromium.

If any of the aforementioned constituents are present above the applicable III. Admin. Code Part 620 groundwater quality standards, confirmation sampling shall be initiated. If additional sampling confirms elevated concentrations, Chemetco will propose a Phase II investigation.

7.6. Conclusion

The purpose of the Phase I groundwater investigation contained in Section 7 is to determine the presence/absence of hazardous constituents in shallow groundwater related to the zinc oxide spill. Subsurface borings, a properly constructed monitoring well system and water quality analyses will allow such a determination.

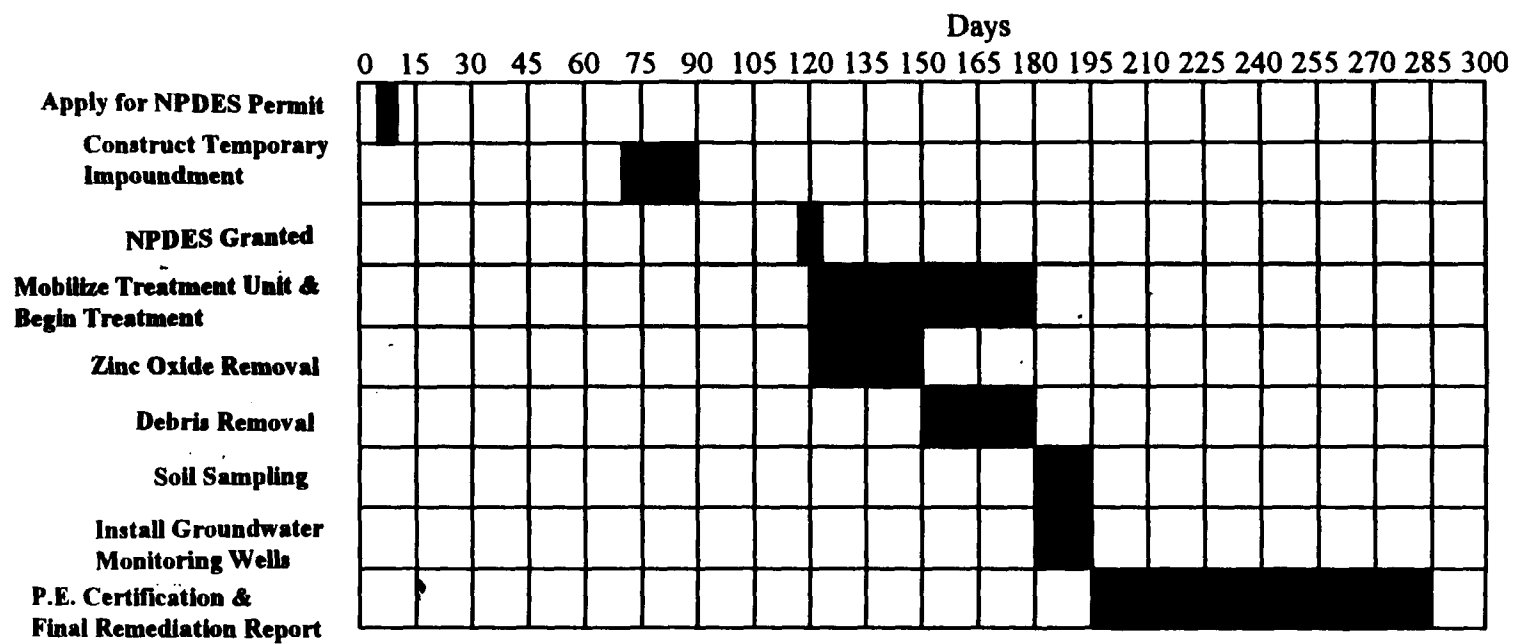
A Phase I Report shall be prepared by Chemetco to be submitted to the Agency and at a minimum will include the following information:

- Boring logs;
- Well completion reports;
- A description of the geology/hydrogeology in the vicinity of the zinc oxide spill;
- Two scaled geologic cross-sections with the interval over which the wells are screened clearly marked;
- An appropriately scaled map which shows the locations of borings, surface features, property boundaries, roads, spill area, etc.;
- Results of water quality analyses;

- Results of any hydraulic conductivity testing; and,
- Determination of groundwater class pursuant to 35 Ill. Admin. Code Part 620.

At such time as the results from the Phase I investigation indicate that further action related to groundwater is necessary, Chemetco shall propose additional investigation including a Phase II and/or Phase III investigation, as appropriate.

TABLE 8.1
REMEDIATION SCHEDULE
CHEMETCO, INC.



FIGURES.

